A Study of Statistical Process Control

Henry R. Neave

How effectively is SPC being taught—and used? We believe that the following report about British companies would find an echo in the U.S. The UK Economic and Social Research Council supported an investigation of the use and training of SPC, conducted by Peter Cheng with the assistance of Samuel Dawson. (Dr. Cheng is a research fellow in the ESRC Center for Research in Development, Instruction, and Training at the University of Nottingham.) In the study, semi-structured interviews were conducted with managers and engineers who were responsible for SPC. Ten manufacturing companies, producing a wide variety of products and ranging in size from 10 to 400+ employees, participated. The main findings were:

- The machine operators in companies using SPC most effectively had generally benefited from better levels of education or training (or both).
- In those companies, there was less involvement of engineering and managerial levels in the day-to-day use of SPC. Operators not only recorded and plotted data on control charts, but also interpreted the charts and often attempted the diagnosis and solution of problems.
- A variety of approaches to training was found, from traditional classroom courses to interactive computer and video systems. The effectiveness of both older and newer modes of teaching appeared limited. The difference in most of the successful SPC companies was that the training was generally augmented with supervised hands-on work on the shop floor.
- There were major education and training needs at all levels in most of the companies, from chart completion skills for operators, right through to basic conceptual knowledge about SPC at managerial levels.

Henry Neave read and commented on a draft of this report, and in a number of conversations with Dr. Cheng, interpreted the findings in a wider context than was possible in the study itself. The essence of Dr. Neave's comments is reproduced in the dialogue which follows.

Cheng: Thank you for reading the paper.

Neave: As I suspect will be no surprise to you, I found the findings of your report to be profoundly disturbing.

Cheng: Yes, we were continually surprised by how ineffectively the companies were using SPC and the inappropriateness of their forms of training.

Neave: But I think your report reveals many deeper problems that would be interesting to

consider. Even your introduction, in which you state "Statistical Process Control (SPC) is one of the basic tools of TQM," indicates one root of the problem. If indeed SPC is regarded as a mere tool of TQM, the reasons for most of the difficulties reported by you become immediately self-evident. For, as Don Wheeler pointedly concludes in his video, "A Japanese Control Chart," SPC is not a tool or technique. SPC is a whole new way of thinking. If that way of thinking is absent, most of the power of SPC is automatically lost, or at least hidden. It is, therefore, hardly surprising that you found many people, at all levels in the various organizations you examined, who were not exactly turned on by the topic! (That happens when the blind lead the blind, which I fear is an apt description of much of the "training" mentioned in your report.)

Cheng: That SPC is more than a tool is something many of the engineers and managers did seem to appreciate, although we found that they were, in reality, just using it as a tool.

Neave: There are plenty of other clues in your report as to the sources of difficulties. For example, SPC is not "a relatively complex and difficult tool to learn and to use"—although I agree that most teachers and consultants manage to make it appear so! Furthermore, variation is not "a hard concept to understand."

Cheng: Learning and using SPC was not such a problem in the better companies, but it certainly was for many employees in the other companies, who had low levels of education (even lacking basic numeracy). Some employees even found it difficult to fill in a control chart, let alone relate particular patterns in those charts to problems in a process. A lack of basic education was one of the fundamental problems we identified.

Neave: You are right to say that "a knowledge of statistics is not essential in order for operators to use SPC." Truth is, a "knowledge of statistics" (assuming you mean the usual stuff taught in most educational institutions throughout the country) is a positive hindrance at any level. Walter Shewhart himself (the creator of SPC and the control chart in the 1920s) expressly—indeed passionately—denied the need for such "knowledge of statistics." And this denial became even more explicit when expressed by Shewhart's most famous protégé, Dr. W. Edwards Deming. In *Out of the Crisis*, page 335, he writes: "It is true that some books on the statistical control of quality and many training manuals for teaching control charts show a graph of the normal curve and proportions of area thereunder. Such tables and charts are misleading and derail effective study and use of control charts."

Another clue to the origin of the problems related in your report is the repeated use of the word "training" in respect to learning about SPC. I interpret the word "training" in terms of the acquisition of specific skills: how to do things, but not why. Thinking, learning, interpreting, understanding, developing knowledge: these are what SPC is really about. And these are not "training." These are education. People often trot out the phrase "training and education" as if the two were one and the same. They are not. There again we have a cause of the difficulties you have found.

Cheng: Most interesting. The most common perception we found was that SPC is a training matter. Although to be fair, much of the material that we examined did attempt to give some explanation

of why SPC is essential, albeit peripherally.

Neave: Incidentally, this also explains why you discovered many people who thought that SPC training needed to be industry-specific, or even job-specific. When there is no understanding, the best anyone can do is to copy. But if instead they are helped to understand SPC, there may be virtue in not being job- or industry-specific. A deep understanding of SPC brings about an appreciation of its generic and universal nature.

Cheng: Ideally, we would hope that learners would understand that concept. But from what we know about learning and instructional theory, a balance between the abstract and concrete is essential for effective learning. I think the successful companies that included project work in their training were getting the mixture about right.

Neave: A further clue into the difficulties you isolated was your statement that several of your companies got into SPC because of "the drive for improved quality." I could find no indication in your report of control charts being used for quality improvement. All I saw was, at best, corrective action when out-of-control conditions were diagnosed. That is mere maintenance of the status quo, not improvement.

Another clue to the root of the problem, perhaps the most serious one of all, is the limitation of applications to production processes. By far, the more important and valuable applications are to management processes: "The most important application of the principles of statistical control of quality...is the management of people." (Deming, *The New Economics*, pp. 37-38).

Cheng: Unfortunately, we simply found little evidence of SPC being used for anything else but maintenance of the status quo in production.

Neave: Yet all processes of all types naturally contain variation, and it is variation which makes processes relatively difficult to manage and to improve. SPC provides understanding of the nature of the variation in a process. Thus, it is the essential guide to good management and improvement of the process.

You cite many instances of people not reacting appropriately to indications from the control charts. You must understand that it is the organizational culture and the style of management which prevent them from doing so.

Cheng: Yes, this is a reflection of the second fundamental issue we note in the conclusion. There is a significant lack of understanding of SPC at senior managerial levels in the companies we studied, with many of the companies even organized in ways that were counterproductive to the effective use of SPC and its integration into their systems.

Neave: Let me conclude with a quote from Deming's book, *The New Economics*, (page 37): "Somehow the theory for transformation has been applied mostly on the shop floor. ...This is important, but the shop floor is only a small part of the total. Anyone could be 100 percent successful with the 3 percent, and find himself out of business."

Every use of SPC that you encountered during your study belongs to that 3% (shop floor)

and as you found, even much of that small proportion was being carried out ineffectively. Just think of the potential if people could start getting this whole thing right. Maybe your report will encourage some to do just that. If so, your time and effort will have truly been well spent.

Cheng: Thank you very much for these comments and your most valuable insights.

Let us end this article with a quotation from Dr. Neave's book, *The Deming Dimension*, page 415: "Dr. Deming enjoys showing an advertisement for some computer software. The advertisement's headline is: 'Get in Control for Only $59.95.' He remarks: 'I think it'll take a little more than that!'"

This article was first published in ***SPC Ink*** in 1997.

Best known in the U.S. and England as author of the popular book, *The Deming Dimension*, Dr. Neave was the founder of The British Deming Association and also its Director of Education and Research.

Statistical Process Control (SPC) is not new to industry. In 1924, a man at Bell Laboratories developed the control chart and the concept that a process could be in statistical control. His name was William A. Shewart. He eventually published a book titled â€œStatistical Method from the Viewpoint of Quality Controlâ€ (1939).Â SPC is method of measuring and controlling quality by monitoring the manufacturing process. Quality data is collected in the form of product or process measurements or readings from various machines or instrumentation. The data is collected and used to evaluate, monitor and control a process. SPC is an effective method to drive continuous improvement. By monitoring and controlling a process, we can assure that it operates at its fullest potential. Statistical Process Control (SPC) is a method used to monitor different processes in manufacturing. The methods designed to monitor whether the process is in control or not, and what ability it has to produce units (can be both goods and services) that are within set tolerances. In all types of processes there exists variation. In a manufacturing process, usually variables like temperature and humidity, or poorly calibrated measuring instruments that makes the variation.Â In the study of process there exists itself variations, which must be considered in the arrangement and interpretation of the study. Variation can be of various types. Often mentioned discrete and random variation and engineers like to speak in terms of signal and noise. The purpose of SPC is to Statistical process control (SPC) is a method of quality control which employs statistical methods to monitor and control a process. This helps to ensure that the process operates efficiently, producing more specification-conforming products with less waste (rework or scrap). SPC can be applied to any process where the "conforming product" (product meeting specifications) output can be measured. Key tools used in SPC include run charts, control charts, a focus on continuous improvement, and the design Statistical Process Control ensures the process constantly improves. This post details how to take the next step in process control.Â Statistical Process Control is an industry standard quality control method for monitoring, controlling, and improving a process through statistical analysis. It requires the development of set parameters from which a process controller can observe variations and constant real time measurements. The focus of statistical process control is on error prevention, and continuous improvement. CONTENTS. + Quality Control Methods. Statistical process control (SPC) is used to study the process performance and understand sources of variation with the intention of making corrective actions to reduce variation. This brief session covers the basic concepts of statistical analysis and their application to practical problems in process control. It will deal with such standard tools as histograms, X-bar and R charts, process capability studies and sampling plans. It is intended to help attendees decide if SPC will be helpful their activities and whether further training should be sought before applications. Attendees to this se...Â Statistical Process Control â€“ Management Overview. Version 0509. SPC Learning Steps.